Comparison of Soil Type Dependent Tier 1 Risk-Based Target Levels
For Benzene and TPH-GRO
December 30, 2004

TABLE 1
TIER 1 SOIL TYPE DEPENDENT RISK-BASED TARGET LEVELS (RBTLs) FOR BENZENE

	Soil Type 1 (sandy[1])		Soil Type 2 (silty[2])		Soil Type 3 (clay[3])		Tier 1 RBTLs from February 2004 Guidance Document	
	Residential	Non-residential	Residential	Non-residential	Residential	Non-residential	Residential	Non-residential
Surface soil (0-3') combined pathway	8.55 mg/kg	33.9 mg/kg	11.1 mg/kg	33.9 mg/kg	13.3 mg/kg	37.0 mg/kg	10.3 mg/kg	30.5 mg/kg
Subsurface soil (3'-top of groundwater) soil vapors to indoor air pathway	0.234 mg/kg	1.23 mg/kg	0.50 mg/kg	2.62 mg/kg	0.888 mg/kg	4.65 mg/kg	0.042 mg/kg	0.222 mg/kg
Groundwater vapors to indoor air pathway	0.621 mg/L	3.25 mg/L	1.08 mg/L	5.65 mg/L	1.78 mg/L	9.34 mg/L	0.177 mg/L	0.928 mg/L

TABLE 2
TIER 1 SOIL TYPE DEPENDENT RISK-BASED TARGET LEVELS (RBTLs) FOR TPH-GRO

	Soil Type 1 (sandy[1])		Soil Type 2 (silty[2])		Soil Type 3 (clay[3])		Tier 1 RBTLs from February 2004 Guidance Document[4]	
	Residential	Non-residential	Residential	Non-residential	Residential	Non-residential	Residential	Non-residential
Surface soil (0-3') combined pathway	29,000 mg/kg	383,000 mg/kg	29,600 mg/kg	385,000 mg/kg	35,300 mg/kg	390,000 mg/kg	7,800 mg/kg	52,200 mg/kg
Subsurface soil (3'-top of groundwater) soil vapors to indoor air pathway	383 mg/kg	3,080 mg/kg	716 mg/kg	5,760 mg/kg	1,190 mg/kg	9,550 mg/kg	27.6 mg/kg	222 mg/kg
Groundwater vapors to indoor air pathway	20.7 mg/L	167 mg/L	34.6 mg/L	278 mg/L	56.4 mg/L	453 mg/L	4.28 mg/L	34.4 mg/L

[1]Soils included in developing Soil Type 1 (SCS classification): sand, loamy sand, sandy loam
[2]Soils included in developing Soil Type 2 (SCS classification): clay loam, silt, loam, silty clay loam, sandy clay loam, silt loam
[3] Soil included in developing Soil Type 3 (SCS classification): clay, silty clay, sandy clay
[4] Tier 1 RBTLs updated April 30, 2004

Details pertaining to development of soil type dependent Tier 1 RBTLs:

- These Tier 1 RBTLs are based on decisions made by MDNR and the vapor subgroup on or about September 16, 2004, regarding Air Exchange Rate (AER) and benzene slope factors. Decisions concerning soil type dependent parameters and enclosed space parameters (i.e., crack fraction) were made prior to September 16, 2004, and agreed to by the vapor subgroup.
- Fate and transport parameters changed from original defaults (February 2004 MRBCA guidance) to calculate the soil type dependent Tier 1 RBTLs:
  - Soil type dependent parameters: Vadose zone porosity, vadose zone water content, soil in cracks porosity, soil in cracks water content, capillary fringe porosity, capillary fringe thickness
  - Enclosed space parameter: crack fraction (from 0.01 cm^2/cm^2 to 0.001 cm^2/cm^2)
  - Air Exchange Rates:
    - Residential: 12.096 per 24 hrs (ASTM value)
    - Non-residential: 19.872 per 24 hrs (ASTM value)
- Toxicity factors for benzene used in developing soil type dependent Tier 1 RBTLs:
  - Oral slope factor: 2.90E-02 kg-day/mg
  - Inhalation slope factor: 2.90E-02 kg-day/mg
- Toxicity factors for certain TPH carbon fractions, and, by that, TPH-GRO, DRO, and ORO, in the February 2004 version of the guidance were found to be in error. Specifically, the following factors have been changed:
  - Aliphatics
    - >C6-C8 - change inhalation reference dose (RfDi) from 1.514 mg/kg-day to 5.26 mg/kg-day;
    - >C8-C10 - change RfDi from 0.0857 mg/kg-day to 0.286 mg/kg-day;
    - >C10-C12 - change RfDi from 0.0857 mg/kg-day to 0.286 mg/kg-day;
    - >C12-C16 - change RfDi from 0.857 mg/kg-day to 0.286 mg/kg-day;
    - >C6-C8 - change dimensionless Henry's law constant (H) from 51 to 50;
    - >C8-C10 - change dimensionless Henry's law constant (H) from 82 to 80;
    - >C16-C21 - change solubility (S) from 1.3E-06 mg/L to 2.5E-06 mg/L;
    - >C21-C35 - change S from 1.3E-06 mg/L to 2.5E-06 mg/L;
    - >C6-C8 - change dermal RA factor (RAFd) from 0.1 to 0 or NA (unitless); and
    - >C8-C10 - change RAFd from 0.1 to 0 or NA (unitless).

  - Aromatics
    - >C8-C10 - change RAFd from 0.13 to 0 or NA (unitless);
    - >C10-C12 - change RAFd from 0.13 to 0.1 (unitless); and
    - >C12-C16 - change RAFd from 0.12 to 0.1 (unitless).

Data used in developing specific soil types*:

Soil type	Soil (SCS Classification)	Porosity (avg.)	Water content (avg.)	Capillary height (avg.)
1	Sand	0.38	0.08	5 cm
	Loamy sand			
	Sandy loam			
2	Clay loam	0.44	0.17	5 cm
	Silt			
	Loam			
	Silty clay loam			
	Sandy clay loam			
	Silt loam			
3	Clay	0.44	0.21	5 cm
	Silty clay			
	Sandy clay			

*Data from *User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings*, USEPA, June 19, 2003.